

Remarks

This Amendment is made in response to the non-final Office Action of August 17, 2009. The Office Action has been carefully reviewed, and the following remarks are considered responsive thereto.

Claims 1–18 are pending in the present application, prior to entry of this Amendment. Claims 6–12 and 14–18 were amended in a Preliminary Amendment filed June 6, 2006. Clarifying amendments have been made in the present Amendment to independent claims 1 and 4 to place the claims in condition for allowance. Further clarifying amendments have also been made to dependent claims 5, 10, and 17, primarily to make these claims consistent with amendments made to the independent claims. New claim 19 has been added by this Amendment. No claims have been canceled by this Amendment.

It is submitted that no new matter is presented by this Amendment, as all claim amendments and new claims are properly supported by the application as originally filed. In view of the amendments and remarks which follow, reconsideration and allowance of the application and claims is respectfully requested.

The following sections correspond to the sections in the Office Action.

Claim Rejections - 35 U.S.C. §§ 102, 103

In the Office Action, claims 17–18 were rejected under 35 U.S.C. § 102(b), or in the alternative 35 U.S.C. § 103(a), as allegedly being anticipated by or unpatentable over either *Conradie, E. H. et al.*, “SU-8 Thick Photoresist Processing as a Functional Material for MEMS Applications”, or *Warren* (U.S. Patent Pub. No. 2002/0115016).

Additionally, claims 1–18 were rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over *Minsek et al.* (U.S. Patent No. 6,716,568), *Ohkubo et al.* (U.S. Patent No. 5,118,518), and *Zhong-geng Ling et al.*, “Improving Patterning Quality of SU-8 Microstructures by Optimizing the Exposure Parameters”.

In response, Applicants submit that the cited references, whether taken alone or in combination, are insufficient to support either a 35 U.S.C. § 102(b) or a 35 U.S.C. § 103(a) rejection of the present claims. Specifically, Applicants assert that the cited references, whether

taken alone or in combination, simply fail to teach, suggest, or describe the limitations of the present claims, as amended. Applicants' discussion of the cited references and the present claims is presented in detail as follows.

The first cited reference, *Minsek*, generally describes an "epoxy photoresist composition with improved cracking resistance." [*Minsek*, Title]. Specifically, this patent describes a "photoimageable composition suitable for use as a negative photoresist." [*Id.* at Abstract]. In essence, this reference is directed to the composition of a photoresist itself, and not to a process for producing high aspect ratio parts from a photoresist, or to the end-parts themselves. The reference does generally refer to conventional, lithographic process steps, but in so doing describes a photoresist thickness of only 55 μm or less, a maximum exposure dose of 800 mJ/cm^2 , and does not describe the use of filters for filtering ultraviolet (UV) light during exposure. [See *id.* at col. 8, example 4].

The second cited reference, *Ohkubo*, generally describes a "substrate for information-recording media." [*Ohkubo*, Title (emphasis added)]. Specifically, the *Ohkubo* reference describes a "substrate which is formed of a polymer containing a specific acrylate-based monomer as an essential component." [*Ohkubo*, Abstract]. Similarly to *Minsek*, *Ohkubo* is directed to a composition or substrate itself, not to a lithographic process or parts made from such a process. In fact, *Ohkubo* has absolutely nothing to do with lithographic processes using SU-8 type photoresists, as described by the present application.

A third cited reference, *Warren*, generally describes lithographic processes using SU-8 photoresists. [See *Warren*, Abstract]. The processes described, however, may only be performed on photoresists having thicknesses less than 700 μm , and at exposure doses between 200-1000 mJ/cm^2 . [See *id.* at para. 12]. Additionally, the greatest aspect ratio part capable of being produced by the process in *Warren* is 8:1. [See *id.* at para. 29]. Further, *Warren* does not describe the use of filters to filter out certain amounts of light during irradiation, as described by the present claims.

Another cited reference, *Conradie*, generally describes the use of SU-8 as a functional material. The processes described in the *Conradie* reference are conventional lithographic processes performed on photoresists of 50 μm or less, and do not incorporate light filters. In

fact, the processes described in *Conradie* are standard processes recommended by MicroChem Corp., a well-known supplier of SU-8 materials, and are irrelevant to the claims at issue.

The final reference cited in the Office Action, *Zhong-geng Ling*, presents a discussion of exposure parameters on SU-8 microstructures. Even in exploring the bounds of exposure, *Zhong-geng Ling* describes recommended total energy densities of no more than 3,000 mJ/cm². Additionally, the maximum aspect ratio claimed possible via the processes in *Zhong-geng Ling* is 25:1, and the reference does not describe the ability to filter out certain amounts of light during irradiation.

In stark contrast to the cited references, independent claim 1 recites a process for producing high aspect ratio parts from an epoxy-type negative photoresist (e.g., SU-8 photoresist), wherein the process comprises the steps of: (i) irradiating a prebaked masked epoxy-type negative photoresist on a substrate with light at a total energy density of from 18,000 to 35,000 mJ/cm², wherein no more than 15% of the energy density is contributed by light having a wavelength of 400nm or less; (ii) post-baking the exposed photoresist at elevated temperature; and (iii) developing the exposed photoresist in a solvent, whereby a high aspect ratio part is produced. Additionally, independent claim 4 recites a process for producing high aspect ratio parts from an epoxy-type negative photoresist, comprising the steps of: (i) irradiating a prebaked masked epoxy-type negative photoresist on a substrate with a high pressure mercury lamp that emits ultraviolet (UV) light, wherein at least 20% of the UV light emitted from the mercury lamp having a wavelength of 365nm is filtered out; (ii) post-baking the exposed photoresist at elevated temperature; and (iii) developing the exposed photoresist in a solvent.

As mentioned previously, Applicants submit that the cited references, whether taken alone or in combination, simply fail to teach, suggest, or describe the limitations of the present claims, as amended. Specifically, none of the cited references teach or disclose use of filters to filter out certain amounts or levels of light during irradiation, as described by the present claims. For example, independent claim 1 recites the limitation of no more than 15% of the energy density is contributed by light having a wavelength of 400nm or less. Additionally, independent claim 4 recites at least 20% of the UV light emitted from the mercury lamp having a wavelength of 365nm is filtered out. Simply stated, none of the references cited in the Office Action teach,

describe, or even suggest this filtering functionality. Accordingly, based on this point alone, Applicants submit that the 35 U.S.C. § 102(b) and 35 U.S.C. § 103(a) rejections of the claims should be withdrawn.

However, the Office Action asserts that “[i]t would be obvious to filter out the wavelength that is not useful in the polymerization process.” [Office Action, p. 4]. Applicants respectfully traverse this assertion, as well as the 35 U.S.C. § 103(a) rejection of the claims, as the Office Action fails to provide a clear articulation of the reasons why the Examiner contends that the claimed invention would have been obvious, at the time the invention was made, to a person having ordinary skill in the art. As stated in MPEP § 2141, the Supreme Court in *KSR v. Teleflex* asserted that that the analysis supporting a rejection under 35 U.S.C. § 103(a) “should be made explicit” by the Examiner, and MPEP § 2144 states that the Examiner must present “a convincing line of reasoning supporting a rejection.” [citing *KSR International Co. v. Teleflex Inc.*, 550 U.S. ___, 127 S. Ct. 1727 (2007) (emphasis added)]. Moreover, the Court in *KSR* stated that rejections on obviousness “cannot be sustained by mere conclusory statements; [I]nstead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.” [KSR at 1396 (emphasis added)].

Here, the Office Action states that “the percent of at least 20% of the UV light emitted from the mercury lamp having at least a wavelength of 365 nm is filtered out presented in claim 4 would have been obvious to the worker of ordinary skill in the art since the wavelength produced by mercury lamp produces generate wavelength encompasses the scope of wavelength remaining in the spectrum.” [Office Action, p.4]. Aside from the fact that this statement makes no sense in context, the Office Action provides absolutely no authority, support, or rational underpinning indicating why it would be obvious to filter out certain amounts of light at certain wavelengths, as claimed. As recited in the as-filed application, the Applicants “discovered that high aspect ratio structures could only be obtained by filtering out a portion of the light below 400 nm,” and that “[t]his was unexpected since 365 nm light is generally recommended by SU-8 suppliers . . . as the optimum wavelength for exposure . . .” [Specification, p. 3]. Again, Applicants respectfully assert that no support or rational underpinning has been provided showing why it would have been obvious to filter out certain portions of light at certain

wavelengths. Additionally, Applicants point out that although claim 4 was discussed, the Office Action failed to address the element from claim 1 reciting that no more than 15% of the energy density is contributed by light having a wavelength of 400nm or less. For at least these reasons, Applicants respectfully traverse the assertions made in the Office Action regarding the obviousness of these claims.

Further, Applicants assert that none of the cited references, whether taken alone or in combination, teach, suggest, or describe irradiating a prebaked masked epoxy-type negative photoresist on a substrate with light at a total energy density of from 18,000 to 35,000 mJ/cm², as described by independent claim 1. For example, and as mentioned previously, the maximum energy density discussed in *Minsek* is 800 mJ/cm². Further, *Warren* only describes a range of 200 to 1000 mJ/cm², *Zhong-geng Ling* describes a maximum dose of 3000 mJ/cm², and *Conradie* describes illumination of 16 mW/cm². All of these energy densities are much lower than the range claimed in the present claims.

Applicants concede that *Ohkubo* describes polymerization from a mercury lamp producing a total light quantity of 1.0 to 200 J/cm², which encompasses the range in the present claims. However, Applicants submit that this polymerization is not performed on a prebaked masked epoxy-type negative photoresist, much less a photoresist of any kind, and, further, that there is no teaching, suggestion, or motivation to combine this *Ohkubo* reference with the other, cited references. As mentioned, *Ohkubo* relates to a “substrate for information-recording media.” [*Ohkubo*, col. 1, lines 7–8; Title]. Specifically, the substrate described in *Ohkubo* is a “polymer containing a specific acrylate-based monomer as an essential component.” [*Id.* at Abstract]. Examples of such a substrate are believed to be compact discs (CDs), digital video discs (DVDs), and the like. This type of substrate is totally unrelated to SU-8 processing, photoresists, and the like, such that the irradiation parameters described in *Ohkubo* are irrelevant and unusable for epoxy-type negative photoresists, as described by the present claims. Simply put, there is no teaching or suggestion anywhere in the *Ohkubo* reference that would lead one skilled in the art to combine it with any of the other, cited references.

Additionally, Applicants point out that the claimed lithographic processes enable processing of high-thickness photoresists (e.g., 0.701 mm to 1.5 mm) to produce high aspect

ratio parts (e.g., 10:1, or even 40:1, or greater), as described in claims 10, 17, 19, etc., as amended. None of the cited references describe lithographic processes capable of performing such functionality on photoresists of such thickness to produce such high aspect ratio parts. Additionally, Applicants note that none of the cited references teach, and the Office Action did not address, the concepts of multiple exposure filtering (e.g., dependent claims 3, 12, and 13), multi-step post-bake procedures (e.g., dependent claim 12), and others. Because at least these claim elements are not taught or described in *Minsek*, *Ohkubo*, *Conradie*, *Warren*, or *Zhong-geng Ling*, or any other known reference, whether taken alone or in combination, Applicants respectfully request that the 35 U.S.C. §§ 102(b), 103(a) rejection of claims 1–18 be withdrawn.

For the sake of brevity, not every claim or claim element and their associated rejections have been discussed. However, Applicants do not acquiesce in any of the Examiner's assertions and comparisons regarding the cited references and the present claims, regardless of whether they have been specifically addressed in this Amendment.

Additionally, although not dependent claims were specifically discussed, because the dependent claims in the application merely provide additional elements or limitations to the independent claims from which they depend, they should also be allowable, on their own merits as providing unique additional functionality, and separately under the doctrine of *In re Fine*, 5 U.S.P.Q.2d 1597 (Fed. Cir. 1988), which stands for the proposition that if an independent claim is patentable, a dependent claim should also be patentable as it provides further limitations to the independent claim from which it depends.

Accordingly, it is believed that the foregoing amendments and arguments have addressed all of the claim rejections in the Office Action, and have thus placed all pending claims in condition for allowance. Such allowance is earnestly and respectfully solicited.

* * * * *

Conclusion

For the foregoing reasons, it is submitted that all claims are believed novel, nonobvious, fully supported, and should be patentable in view of the art of record. The foregoing is submitted as a full and complete response to the non-final Office Action mailed August 17, 2009, and is believed to place all claims in the application in condition for allowance. Accordingly, it is respectfully submitted that this application be allowed and that a Notice of Allowance be issued. If the Examiner believes that a telephone conference with the Applicants' attorneys would be advantageous to the disposition of this case then the Examiner is encouraged to telephone the undersigned at 404-233-7000.

Additionally, please note that the current Amendment includes 19 total claims and 2. Because Applicants previously paid for 20 total claims and 3 independent claims, no additional claims fees are believed due at this time.

Respectfully submitted,



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